

GENERALIZED NET MODEL OF FORUM SYSTEM WITH USER ACCOUNTS

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Abstract: In this paper is introduced a generalized net that models the forum system with user accounts. The forums are one of the most popular tools for the on-line (and off-line) communication that young people use. The processes in one abstract forum are very different. The model can be used for monitoring and analyzing of the process from supplying with the initial materials to the valuation of the product.

Keywords: Generalized net, Modelling, Forum System.

1. Introduction

Today a large number of Internet users utilize forums to exchange text messages with each other, as well as with the entire world. If we look at Web-based forums, we can see that many users can access the system at the same time, performing various operations, which however depend on each user's characteristics. This process can be represented as a generalized net, which can be used to examine the steps which occur throughout the user's interaction with the system.

There are several things to consider about a user's interaction with the forum system:

- Initial entry into the system, followed by selection of the next step: anonymous access, login or registration
- The user can access the system unregistered if the administrator allows it. Anonymous users have read-only access, while registered users also have different levels of writing access.
- In case of a registration the user inputs his/her data, after which a security check is performed. If the check is successful, the data is recorded into the database. After finishing the registration, the user usually needs to return to the system's start page and log in with the credentials he entered in the registration. The administrator does not need to register, as his/her account is automatically created during the system installation.
- In order to function properly, each forum system needs a database, which can be divided in two halves: a database of the users' personal information and a database with the contents and related information of the messages. These two

halves are usually accessed at different times separately, therefore regarding them as distinct poses no problems.

The operations which the users can perform can be classified as reading, writing and forum administration (which includes control of other people's messages and changing users' information). If anonymous users are allowed, they are only granted reading rights, the regular users get message reading and writing access, while the administrators can do all – both act as normal forum users and control the system.

It is good to remark that in many forum systems users known as moderators also exist, which are similar to administrators, but have no write access to the user database – they can only control the message database, including the ability to delete or alter messages. Here we will omit moderators for greater clarity.

In this paper a generalized net model (Generalized nets, GNs, see [1, 2]) of a system of this kind is constructed. In [3] was described the building up an application, called “forum”. It was realized by Java Server Pages that provides the potential of including the application in any HTML-page, and using it for the needs of any problem area.

The purpose of such an application is to provide the opportunity to discuss questions on a predefined topic, while every user is both able to ask a new question (start a new topic), or answer previously asked question. Every question has an answering option. When other users respond to these messages, a social discussion has been initiated.

2. The Generalized net model

The GN model is shown of the Fig.1. The set of transitions for this model is

$$A = \{Z_1, Z_3, Z_4, Z_5, Z_6, Z_7, Z_8, Z_9, Z_{10}, Z_{11}\},$$

where:

- Z_1 – initial entry transition. All user-tokens enter this transition through L_1 . Here the user decides on his next action and then moves on. Every user could decide to enter and then just leave,
- Z_8 – user type check transition. If the user wants to leave, he/she returns to transition Z_1 ,
- Z_6 – action choice transition for regular users. From here messages can be read and written,
- Z_7 – action choice transition for administrators. Possible actions are reading and writing to both databases,
- Z_3 – message reading transition,
- Z_4 – message writing transition,
- Z_5 – administration transition, connected to both databases,
- Z_9 – message database transition, for reading and/or writing, depending on the type of token.
- Z_{11} – user database transition, for reading and/or writing, depending on the type of token,
- Z_{10} – registration transition, where the user is verified.

Most actions in the forum system are performed by the users, represented here as tokens, which enter into the system from place L_1 , and after their work is done, they exit

through place L_7 . At entry each user-token has the following initial characteristics: “user name, password and desired mode of access – either as anonymous or registered user”.

If the user is not registered, then the user name and password are empty. Before the user's credentials are verified, the token carries a default user type of “anonymous”. In case the user decodes to access the messages in any way, his/her token is directed to transition Z_8 , where the access mode is checked. The user can continue viewing the forum unregistered or log into the system as registered, for which the token needs to go to position L_{38} . After the user name and password have successfully been confirmed in the database (transition Z_{11}), the token receives a new user type - “regular user” or “administrator”. In case the user's credentials cannot be confirmed, the token's user type remains “anonymous”.

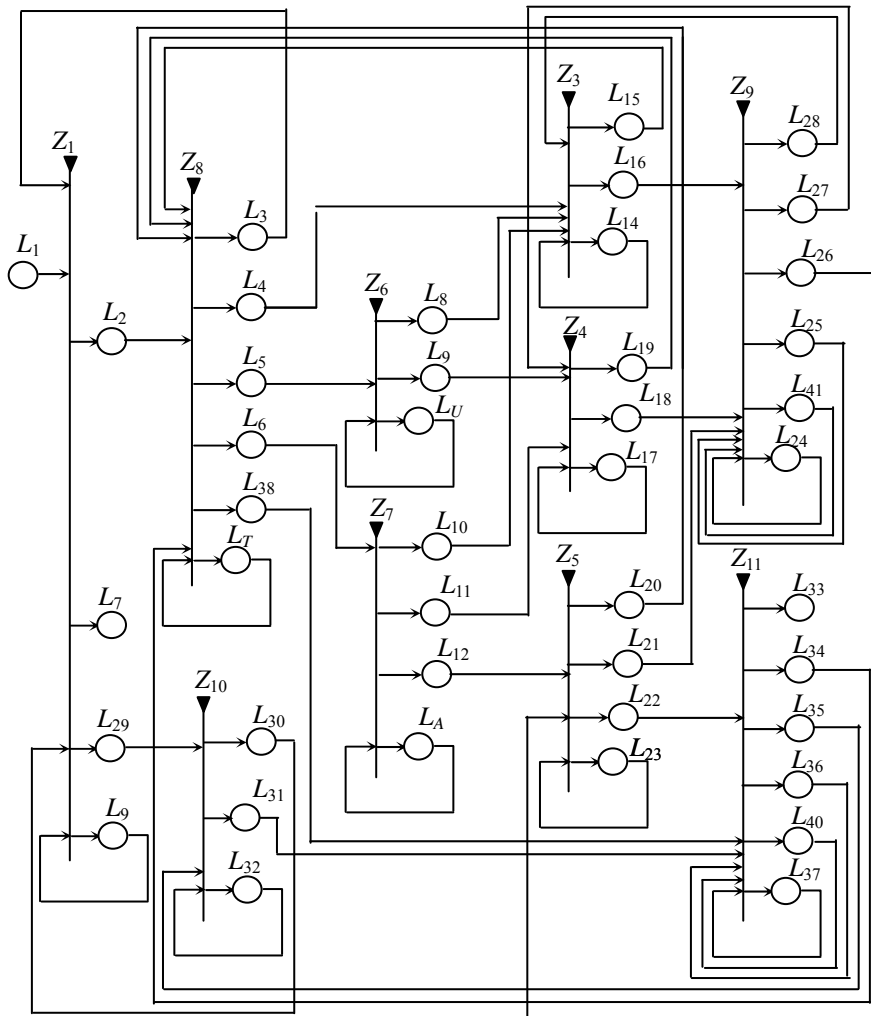


Figure 1. Generalized net model of a forum system with user accounts

At places L_{24} and L_{37} through the entire time the system is functioning there are tokens placed for the two system databases – one for the user accounts and one for the messages. Using the message database the user-tokens receive and send information, which includes the text of the forum's messages. The user account database provides means to check whether any given user-token can receive characteristics that grant it higher access; this way the forum system's security is guaranteed.

Aside from the database tokens at the start of and through the entire duration of the generalized net's operation, there are tokens placed permanently at certain places, and they have the following characteristics:

- at place L_0 : “initial user actions”
- at place L_T : “user types”
- at place L_U : “regular user actions”
- at place L_A : “administrator actions”.

These tokens give the user the ability to select his/her next step, which in turn directs his/her token to a new place.

Now we will take a look at each of the transitions one by one, skipping any temporal elements. A forum system can have a transition activated at any time by any of its users. We will also assume an unlimited capacity for all arcs, because a forum should aim to support a large amount of users accessing the system simultaneously.

$$Z_1 = \langle \{L_1, L_3, L_{30}, L_0\}, \{L_2, L_7, L_{29}, L_0\}, r_1, \vee(L_1, L_0) \rangle$$

$$r_1 = \begin{array}{c|cccc} & L_2 & L_7 & L_{29} & L_0 \\ \hline L_1 & False & False & False & True \\ L_3 & False & False & False & True \\ L_{30} & False & False & False & True \\ L_0 & W_{0,2} & W_{0,7} & W_{0,29} & True \end{array},$$

where:

- $W_{0,2}$ = „The user wants to access the messages in the forum“,
- $W_{0,7}$ = „The user wants to completely exit the system“,
- $W_{0,29}$ = „The user has anonymous status, hasn't registered before and wants to register“.

$$Z_8 = \langle \{L_2, L_{34}, L_{15}, L_{19}, L_{20}, L_T\}, \{L_3, L_4, L_5, L_6, L_{38}, L_T\}, r_8, \vee(L_2, L_{34}, L_{15}, L_{19}, L_{20}, L_T) \rangle,$$

$$r_8 = \begin{array}{c|cccccc} & L_3 & L_4 & L_5 & L_6 & L_{38} & L_T \\ \hline L_2 & False & False & False & False & False & True \\ L_{34} & False & False & False & False & False & True \\ L_{15} & False & False & False & False & False & True \\ L_{19} & False & False & False & False & False & True \\ L_{20} & False & False & False & False & False & True \\ L_T & W_{T,3} & W_{T,4} & W_{T,5} & W_{T,6} & W_{T,38} & True \end{array},$$

where:

- $W_{T,4}$ = „The user is of the type “anonymous” and can enter the system to read“,
- $W_{T,38}$ = „The user seeks regular user or administrator status but doesn't have access“.

confirmation“,

- $W_{T,3}$ = „Either the user is not anonymous and would like to clear his/her access confirmation, so that he/she can re-enter the system with new parameters (or the same as before, but regaining access), or an attempt to get access confirmation as a registered user has been denied“,
- $W_{T,5}$ = „The user has requested the type “regular” and has been confirmed after a check in the user database“,
- $W_{T,6}$ = „The user has requested the type “administrator” and has been confirmed after a check in the user database“.

$$Z_6 = \langle \{L_5, L_U\}, \{L_8, L_9, L_U\}, r_6, \vee(L_5, L_U) \rangle,$$

$$r_6 = \frac{\begin{array}{c|ccc} & L_8 & L_9 & L_U \\ \hline L_5 & W_{5,8} & W_{5,9} & True \\ L_U & W_{U,8} & W_{U,9} & True \end{array}}{}$$

where:

- $W_{U,8}$ = „The regular user wants to read messages“,
- $W_{U,9}$ = „The regular user wants to write messages“.

$$Z_7 = \langle \{L_6, L_A\}, \{L_{10}, L_{11}, L_{12}, L_A\}, r_7, \vee(L_6, L_A) \rangle,$$

$$r_7 = \frac{\begin{array}{c|ccc} & L_{10} & L_{11} & L_{12} & L_A \\ \hline L_6 & False & False & False & True \\ L_A & W_{A,10} & W_{A,11} & W_{A,12} & True \end{array}}{}$$

where:

- $W_{A,10}$ = „The administrator wants to read messages“,
- $W_{A,11}$ = „The administrator wants to write messages“,
- $W_{A,12}$ = „The administrator wants to perform system setup, changes and/or manage the users“.

$$Z_3 = \langle \{L_{28}, L_4, L_8, L_{10}, L_{14}\}, \{L_{15}, L_{16}, L_{14}\}, r_3, \vee(L_{28}, L_4, L_8, L_{10}, L_{14}) \rangle,$$

$$r_3 = \frac{\begin{array}{c|ccc} & L_{15} & L_{16} & L_{14} \\ \hline L_{28} & False & False & True \\ L_4 & False & True & False \\ L_8 & False & True & False \\ L_{10} & False & True & False \\ L_{14} & W_{14,15} & W_{14,16} & W_{14,14} \end{array}}{}$$

where:

- $W_{14,15}$ = „The user wants to quit reading“,
- $W_{14,16}$ = „The user wants to read another message and the token is moved to the message database for a search“,
- $W_{14,14}$ = „The user wants to continue reading“.

It should be noted that place L_{14} is for continuous reading, L_{16} – for connecting with the message database and retrieving new messages to read, and L_{15} – for exiting this operation.

$$Z_4 = \langle \{L_{27}, L_9, L_{11}, L_{17}\}, \{L_{19}, L_{18}, L_{17}\}, r_4, \vee(L_{27}, L_9, L_{11}, L_{17}) \rangle,$$

$$r_4 = \begin{array}{c|ccc} & L_{19} & L_{18} & L_{17} \\ \hline L_{27} & False & False & True \\ L_9 & False & True & False \\ L_{11} & False & True & False \\ L_{17} & W_{17,19} & W_{17,18} & W_{17,17} \end{array},$$

where:

- $W_{17,19}$ = „The user wants to quit writing“,
- $W_{17,18}$ = „The user wants to record a message in the message database“,
- $W_{17,17}$ = „The user wants to continue writing“.

Similarly to the reading transition, here L_{19} is the place for exiting the operation, L_{18} – for recording in the message database, and L_{17} – for writing a new message.

$$Z_5 = \langle \{L_{26}, L_{33}, L_{12}, L_{23}\}, \{L_{20}, L_{21}, L_{22}, L_{23}\}, r_5, \vee(L_{26}, L_{33}, L_{12}, L_{23}) \rangle,$$

$$r_5 = \begin{array}{c|cccc} & L_{20} & L_{21} & L_{22} & L_{23} \\ \hline L_{26} & False & False & False & True \\ L_{33} & False & False & False & True \\ L_{12} & False & W_{26,21} & W_{26,22} & True \\ L_{23} & W_{23,20} & W_{23,21} & W_{23,22} & W_{23,23} \end{array},$$

where:

- $W_{26,21}$ = „The user wants to administer the message database“,
- $W_{26,22}$ = „The user wants to administer the user database“,
- $W_{23,20}$ = „The user wants to exit the administration mode“,
- $W_{23,21}$ = „The user wants to write data and sends a request to the message database“,
- $W_{23,22}$ = „The user wants to record user data and sends a request to the user database“,
- $W_{23,23}$ = „The user continues administering the forum system“.

$$Z_9 = \langle \{L_{16}, L_{18}, L_{21}, L_{25}, L_{41}, L_{24}\}, \{L_{28}, L_{27}, L_{26}, L_{25}, L_{41}, L_{24}\}, r_9, \vee(L_{16}, L_{18}, L_{21}, L_{25}, L_{41}, L_{24}) \rangle,$$

$$r_9 = \begin{array}{c|cccccc} & L_{28} & L_{27} & L_{26} & L_{25} & L_{41} & L_{24} \\ \hline L_{16} & False & False & False & True & False & False \\ L_{18} & False & False & False & True & False & False \\ L_{21} & False & False & False & False & True & False \\ L_{25} & W_{25,28} & W_{25,27} & False & W_{25,25} & False & False \\ L_{41} & False & False & W_{41,26} & False & W_{41,41} & False \\ L_{24} & False & False & False & False & False & W_{24,24} \end{array},$$

where:

- $W_{25,28}$ = „The user's reading has ended, so the token returns to the reading transition“,
- $W_{25,27}$ = „The user's writing has ended, so the token returns to the writing transition“,
- $W_{25,25}$ = „The processing of a user's reading or writing request continues“,

- $W_{41,26}$ = „The administration request has concluded, so the token returns to the administration transition“,
- $W_{41,41}$ = „The processing of an administration request continues“,
- $W_{24,24}$ = „The token is that of the user database and operations continue“.

The user-token interacts with the database token, receives information from it, and also sends information to it.

$$Z_{11} = \langle \{L_{22}, L_{38}, L_{32}, L_{36}, L_{40}, L_{37}\}, \{L_{33}, L_{34}, L_{35}, L_{36}, L_{40}, L_{37}\}, r_{11}, \forall(L_{22}, L_{38}, L_{32}, L_{36}, L_{40}, L_{37}) \rangle,$$

$$r_{11} = \begin{array}{c|cccccc} & L_{33} & L_{34} & L_{35} & L_{36} & L_{40} & L_{37} \\ \hline L_{22} & False & False & False & False & W_{22,40} & False \\ L_{38} & False & False & False & W_{38,36} & False & False \\ L_{32} & False & False & False & W_{32,36} & False & False \\ L_{36} & False & W_{36,34} & W_{36,35} & W_{36,36} & False & False \\ L_{40} & W_{40,33} & False & False & False & W_{40,40} & False \\ L_{37} & False & False & False & False & False & W_{37,37} \end{array},$$

where:

- $W_{22,40}$ = „A read or write is performed regarding management of the system's users“,
- $W_{38,36}$ = „A check is made in the database on a user's authenticity“,
- $W_{32,36}$ = „A user registration is performed in the database“,
- $W_{36,34}$ = „A confirmation or a denial for the user's authenticity has been received“,
- $W_{36,35}$ = „A user's registration in the database has concluded“,
- $W_{36,36}$ = „The data processing continues“,
- $W_{40,33}$ = „The processing of an administration request has ended, the token returns to the administration transition“,
- $W_{40,40}$ = „The processing of an administration request continues“,
- $W_{37,37}$ = „The token is that of the user database“.

$$Z_{10} = \langle \{L_{29}, L_{31}, L_{35}\}, \{L_{30}, L_{31}, L_{32}\}, r_{10}, \forall(L_{29}, L_{31}, L_{35}) \rangle,$$

$$r_{10} = \begin{array}{c|ccc} & L_{30} & L_{31} & L_{32} \\ \hline L_{29} & W_{29,30} & False & W_{29,32} \\ L_{31} & W_{31,30} & False & False \\ L_{35} & False & W_{35,31} & False \end{array},$$

where:

- $W_{29,30}$ = „The user quits registration“,
- $W_{29,32}$ = „The recording of a user in the user database starts“,
- $W_{31,30}$ = „The registration has been finished and confirmed“
- $W_{35,31}$ = „The user has been recorded in the database, so now a check (usually by e-mail) can be performed“.

3. Conclusions

Here was introduced a generalized net that models the forum system with user accounts. This model can be implemented as a part of bigger model for investigation of social groups. Of course, the model can be used for communication in one e-learning system in every university.

References

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